Teaching without a blackboard and chalk: conflicting attitudes towards using ICTs in higher education teaching and learning

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Abstract

This article, derived from a three-year ethnography of distributed medical education provision in a Canadian university, explores the ways in which ICTs are used by teachers and students in their everyday work within technologically rich teaching environments. The environments being researched are two university campuses: a campus at the main university site, and a satellite campus in a neighbouring province. The article seeks to contrast dominant, institutional discourses of technology use in higher education teaching with the everyday practices of staff and students. The article concludes that there is a gap between policy and practice in distributed education and that the teaching and learning experience and context of staff and students in different sites need to be analysed in depth, in terms of: whether the experience of learning across sites can be positioned as being comparable; the extent to which technology ameliorates learning and teaching; and understanding the work done by staff.

Key words

Distance learning; distributed medical education; ethnography; higher education; information and communication technologies.

Setting the scene

Higher Education in a Digital Economy (HEDE) is a three-year research project funded by the Social Sciences and Humanities Research Council of Canada (SSHRC). The broad aims of the project are to explore issues at one university in Canada surrounding the implementation, from September 2010, of a new medical education curriculum distributed across two campuses, which are 400 kilometres apart. This new distributed medical education (DME) curriculum has been designed to rest on information and communication technologies (ICTs) from the ground up. The application of technology (digital video, digital learning platforms, e-learning devices and such like) functions as a means to enact synchronously the DME curriculum across the two campuses: Main Campus and Satellite Campus. At both sites, large lecture theatres and smaller seminar rooms have been equipped with videoconferencing systems. Irrespective of size, all of these teaching spaces are equipped with arrays of monitors that allow not only for the display of media-rich teaching materials (the curriculum is delivered on a largely paperless basis) but also for staff and students at one campus to see and to hear their counterparts at the other, during lectures or seminars. Camera and microphone systems in the teaching rooms allow for synchronous teaching by one member of faculty staff across both sites, for question-and-answer sessions that students at both sites can take part in, and for the recording of lectures and seminars for future revision and reference. Press-button systems allow students to activate the microphones in front of them (there is a microphone at every seat) so that their counterparts at the other campus can hear their questions whilst the cameras that each room is equipped with focus on them and transmit their image to a screen at both sites. Teaching materials are collected and formatted in advance of each lecture or seminar by a specialist team who are more widely responsible for the technological infrastructure – ICTs, cameras, microphones and so forth – that the curriculum rests on.

This specialist team of technicians work out of control rooms (one at each site) from where they orchestrate

the technologies that are in use during lectures, seminars and other meetings. Main Campus is (unsurprisingly bearing in mind the nomenclature that we have used in rendering the campuses pseudonymous) larger and busier than Satellite Campus. The size of the student cohort at Main Campus is more than three times that at Satellite, and it is at Main Campus that the bulk of 'real world' teaching takes place, with students at Satellite participating via the videoconferencing system.

A framework for inquiry

Higher Education in a Digital Economy aims to explore the lived experience of students and faculty as participants within a technologically mediated distributed medical education (DME) curriculum, and to contrast these experiences with the dominant discourses of technologically distributed medical education scripted by the institutional context. As ethnographers, we are interested in the ways in which the people who actually 'do' the curriculum – the students and the lecturers – work with, make sense of and talk about it. We are interested in what they do at a local level, in lecture halls or seminar rooms, on an everyday basis.

Such a focus on the everyday work and experiences of people, and the ways in which these are coordinated or mediated is characteristic of institutional ethnography (IE), which provides one of two elements of the framework for inquiry for our research (Campbell and Gregor, 2004; Smith, 2005; Taber, 2010; Tummons, 2010; Walby, 2013; for a detailed account of our research methodology, see Tummons, MacLeod and Kits, 2015). IE is a framework that explores everyday work (understood in IE as being anything that people do that requires effort, intent and some acquired competence) at a *local* level. In our research, this work might be the giving of a lecture, the troubleshooting of a technical problem during a videoconference session, or the asking of a question by a student. The local might be at the level of the lecture hall, the seminar room or the office. The local, in IE, is always linked to the *trans-local*: those social, administrative or geographical spaces that are outside the boundaries of people's everyday experience. In our research the trans-local is understood as being positioned at two levels. Firstly, there is the university within which the curriculum is delivered; and secondly there is the profession with which the curriculum is aligned.

In order to explore the ways by which these networks between the local and the trans-local are accomplished, we draw on a second element of our framework for inquiry: sociomateriality, and more specifically actor-network theory (ANT) (Latour, 2005; Law, 1994; for a detailed account of our conceptual framework, see MacLeod et al., 2015). Actor-network theory is a sociological framework that is increasingly widely used within educational research in order to explore the relationships between the human (students, lecturers, technicians) and non-human (handbooks, tablet computers, textbooks) elements that constitute educational curricula, and to consider the ways in which these elements are arranged across temporal, spatial and geographical boundaries. Previous ANT studies have explored medical education, adult basic education, management studies, physics, and teacher education (Bleakley, 2012; Fenwick and Edwards, 2010; Hamilton, 2009; Nespor, 1994; Tummons, 2014b). Arguably the most significant impact of ANT-informed studies (in education and elsewhere) has been the focus given on the relationship between human and non-human elements. In an ANT analysis, it makes no difference whether the network constituents being explored are people, or things (in ANT, referred to as the *principle of symmetry* (Latour, 2005)). Both

human and non-human elements need to come together and be held together in order to accomplish the social project that is being explored: in this case, the enactment of the DME curriculum.

Context: ICTs and distance learning in professional higher education

There is a considerable body of literature reporting on research relating to the use of ICTs in higher education teaching, through which researchers have identified a number of problematic and interrelated elements. Three of these elements are of particular relevance to our research project. The first relates to the pedagogic beliefs and practices of HE teachers when using ICTs. According to these accounts, ICT use needs to be understood as externally guided by policy, not academic, drivers, which reflect discourses of globalisation and massification in higher education and which position the greater use of ICTs as a response to greater student numbers and diminished financial resources (Oliver and Conole, 2003; Price and Kirkwood, 2013), requiring the academic to use ICTs within a broader shift relating to professionalism amongst university teachers (Unwin, 2007). The second element to be considered is the dissonance between pedagogic theory and practice, and technology. These dissonances have been articulated in several ways, although they can be seen as variations on a single theme: as being between the reality of HE teaching and learning practices (Breen et al., 2001), and the rhetoric of institutional policies relating to e-learning and ICT use (Habib and Johansen, 2014); as being between pedagogy and technology (Unwin, 2007); as being between semiotic needs and technological needs (Blin and Munro, 2008); and as being between educationalists and technicians (Joy et al., 2014). The third element to be considered is the ambiguous impact of technology within teaching spaces. Resting within a broader critique of research into technology that focuses too much on processes and too little on student learning, this element serves to remind us firstly that it is often difficult to isolate the impact of ICTs within broader curricular reform; and secondly, that much research reflects the experiences of early adopters rather than more representative samples of university teachers (Kirkwood and Price, 2013). Much of the literature speaks to the specific problem that we address here: the gap between policy and practice in the use of ICTs for distributed provision in higher education. We argue that the dominant institutional discourse of ICT use that the University has constructed positions ICTs as providing a straightforwardly comparable learning experience between the Main and Satellite campuses, as providing a qualitatively better teaching experience for staff and students, and as being trouble-free in implementation and adoption (a separate paper that explores this discursive construction is under preparation).

Alongside these issues, it is necessary to highlight the specificities of distance learning that characterise the DME curriculum that we are researching (Richardson, 2000: 1-13), mindful of the fact that university-based distance learning provision, as a curricular model, should not be conflated with the use of ICTs to facilitate learning more generally. It is the fact that our research is exploring both face-to-face and distance provision that constitutes one of the *problematic* aspects of our research (Smith, 2005). Thus, we define distance learning according to four commonly agreed-on components. Firstly, it is institutionally based; secondly, it is characterized by separation (geographic and/or temporal) of teacher and student; thirdly, it uses either synchronous and/or asynchronous telecommunications; and fourthly, it rests on the sharing of resources. As an example of distance learning provision, the DME curriculum that is the focus of our research therefore relies heavily on the adoption and integration of both technologies (videoconferencing, Web conferencing,

and content-sharing platforms) and people to support the development and use of these technologies (Caladine, Moore and Morris, 2000; Greenhow, Robelia and Hughes, 2009; Simonson, Smaldino, Albright and Zvacek, 2012; Simpson, 2002; Toomey, Lovato, Hanlon, Poole and Bates, 2013).

Observing distributed medical education

Different methods for constructing data have been employed within the *Higher Education in a Digital Economy* project, including document analysis (60 different institutional texts have been analysed) and semi-structured interviews (16 interviews have been conducted at the time of writing with administrative staff, academic staff and technical support staff). Document analysis and interviewing are methods that are characteristic of institutional ethnography (IE): indeed they are, arguably, more prominent in IE than in 'traditional' anthropological ethnography (McCoy, 2006; Smith, 2006). The findings reported in this article are derived from ethnographic observations (at the time of writing, two other papers drawing on other data are in preparation). Five members of the research team conducted a total of 108 observations across both campuses between January and November 2013. They were carried out in lecture halls, seminar rooms, staff meeting rooms and technician's control rooms. The majority of observations lasted for between one and two hours, reflecting the typical length of lectures and seminars in the curriculum. The data from the observations has been analysed by different members of the research team, a process that has been facilitated through the use of qualitative data analysis software (Tummons, 2014a), drawing on a conceptual framework derived from Spradley (1980) centred around: the spaces where observations took place; the actors, activities and objects involved; time; the goals behind the actions; and the feelings of those involved. We argue therefore that our findings are robust as they are based on the systematic analysis of a meaningful body of data.

From our observation data, we have established six initial themes that are relevant to the account presented here. It is not the intention of the analysis presented here to assume that the extracts from our field notes that are presented here speak exclusively to the theme that they accompany below. Rather, it is hoped that upon reading the data and the commentary, the ways in which these themes overlap becomes clear. We suggest that these themes demonstrate the authentic, everyday working practices of staff and students who are involved in the curriculum and provide a clearly identifiable contrast to the use of ICTs that is presented in the official institutional discourse.

[i] Technologies of the classroom

> A few minutes before it [the videoconference] is supposed to end, there is a warning signal indicating to the people in the room that it will end shortly. This mechanism/built in software feature is a reminder that we are living in thirty minute teaching blocks that need to be reserved [...] And then the screen just goes black, regardless of what is happening.
>
> [Seminar observation, February 2013, Main Campus].

> [There are] two big screens in front – both screens have [the] PowerPoint slides. There are also two smaller screens at the back with the same slides. [There is] also a big computer screen at the podium, and also a smaller computer screen.
>
> [Lecture observation, May 2013, Main Campus].
>
> There is a clear difference in how the sites are perceived remotely; the Main lecture theatre is on an angle, and the lecturer from Main clearly needs to 'look up' at the students (as in a traditional university lecture theatre). In contrast, the Satellite based classroom is on the level, with all student ranks on the same level. When a lecturer is speaking to the students in Main, they look up and are not looking directly at the students in Satellite. This could diminish the 'realism' of it being a single classroom depending on where the lecture originates. The converse would be true for lectures being given from Satellite to Main.
>
> [Lecture observation, August 2013, Satellite Campus]

The obvious investment in, and related reliance upon, state of the art information technology is conspicuous within all of the different teaching spaces, from lecture rooms to seminar rooms. The small cameras and microphones, which both staff and students need to learn to use in order to participate in discussion or ask questions, are easily visible. There are large screens at the front of all of the rooms: one screen projects an image of the lecturer, one the PowerPoint slides, and one an image of the counterpart room at the other campus. One can imagine that getting to know students or classmates in such an environment is challenging, especially given some of the inherent technological constraints such as an inability to communicate with each other across the campuses outside formal lecture time due to the automatic shut-off system (described above), preventing the kinds of informal conversations or questions that characterize the end of a formal lecture or seminar. Other issues can be seen to have an impact on classroom practice, such as the ways in which the angle of the cameras influences one's ability to read the expressions of students and colleagues at the other campus. Where people sit limits their on-screen visibility: at Main Campus, students invariably choose to sit at the edges of the lecture room, outside the main field of vision of the cameras: a choice facilitated by the fact that the lecture hall contains more seats than there are students. At Satellite Campus, where the accommodation is smaller, there is less choice over where to sit.

[ii] Engagement and personal technology

> I have this preconceived idea going into these lectures that medical students will be so serious and pay complete attention in class [...] but I see many students, as in other undergraduate classes in sociology etc., on facebook, watching YouTube, not paying attention at all, and looking bored.
>
> [Lecture observation, January 2013, Main Campus].
>
> I recognize little tech jingles – the Windows song, the outgoing mail Mac song, the text notification on an iPhone. Lots of technology 'white' noise. You can hear keyboards and typing if you listen carefully.

> [Lecture observation, February 2013, Main Campus].
>
> Three women sitting next to me are all writing on paper. Otherwise [there are] a significant number of Ipads and other mobile devices. They have loaded the PowerPoint and are taking notes on them. Different students seem to have different systems. The configurations of software [and] hardware could be endless.
>
> [Lecture observation, May 2013, Satellite Campus].

It is common practice for students to use a variety of ICTs in their learning (Biggs, 2003; Laurillard, 2002). However, our observations demonstrate that the affordances of these technologies influence students' practices in lectures and seminars. Some distractions are appropriate: for example, the facility to break away from the lecture PowerPoint in order to review modular or curricular documentation. Other distractions are inappropriate: for example, checking eBay or Snapchat. This is not to say that students would not have distractions in 'traditional' lecture rooms (whatever they might be). Rather, it is the case that newer technologies inevitably introduce new social practices including, therefore, new forms of distraction. And whilst a lecturer might be able to identify and address these distractions in a face-to-face setting, it is difficult to notice such things at the remote campus, which the lecturer can see, but not well, and which s/he cannot hear unless a specific question is being asked.

[iii] Teaching

> The professor left [the] field of vision of camera and went off screen. And then she said "oh, sorry," and moved back into field of vision of screen. [I am] not sure who told her to move back to her place – or did she notice herself? The fact that she apologized indicates she was told but [I] can't be sure. It shows that the professor is under surveillance. She has to move only within a limited range [and] has to be on screen at all times. Constraining?
>
> [Lecture observation, January 2013, Main Campus].
>
> The workshop facilitator said at one point that it is "very challenging to run a workshop this way, across two sites".
>
> [Seminar observation, February 2013, Main Campus].
>
> It's rare for the lecturer to be in Satellite, so there's some buzz in the room about...the unusualness of the lecturer being here.
>
> [Lecture observation, May 2013, Satellite Campus].

In a traditional face-to-face lecture, a lecturer might have stood in front of a class of students who were largely taking notes on paper. The lecturer may have written on a blackboard, walked around the room, and approached and interacted with students during the lecture (Light et al., 2009). But for members of staff delivering lectures and seminars in this distributed medical education programme, both attention and visual field are now subdivided: microphones and cameras are needed so that the students in the remote location

can see and hear the lecturer – the distribution online of the lecture notes is also required. The lecturer has to pay attention to the embodied students in the room (those *physically* present), the disembodied remote students on a screen (those *virtually* present), and the technologies required to display teaching materials, queued questions, the images of the virtually present students, and so forth. The lecturer also has to pay attention to movement and is required to stay in a particular area indicated by a floor so that she or he remains visible to the camera. If the lecturer steps outside the camera range they get an audible cue from the technicians who are overseeing the lecture. Certainly, this influences the ability of a lecturer to draw upon embodied teaching practices, such as moving closer to a student to gain attention or using gesture or other *embodied practices* or *paralanguage* for emphasis (Duck and McMahan, 2012; Vick and Martinez, 2011).

[iv] Asking and answering questions

> The technology orders the questions. [There is] always a bit of hesitancy and awkwardness when waiting to see who pops up on the screen. [...] People seem to be uncertain about when they will be called upon – where they fall in the queue. [One says], "I apologize for speaking out of turn. I really don't know how to use the button system, which is embarrassing." When something goes wrong with the button and hence the ordering of questions, a bit of controlled havoc breaks out. [...] Finally, the people with the questions decide to shift seats to make the technology match with the order they want to speak in. [It's] too complicated to figure out the button – easier to switch seats.
>
> [Lecture observation, February 2013, Main Campus].
>
> I briefly talked to two [students] who were sitting next to me. One said, "I hate it when [Main Campus students] can go up to the lecturer after class. Why not ask questions during class? We [Satellite Campus students] have to email to get answers and they can go to the [lecturers'] offices.
>
> [Lecture observation, May 2013, Satellite Campus].
>
> Several times, [the lecturer] had to remind students to push the [microphone] button. Students are looking very self-conscious and pained when they see themselves on the screen and they probably know they are also shown in larger view at Satellite Campus. The students around the button-pusher often seem more surprised and pained [...] like they are caught on the [giant screen] at sports events. [The lecturer] said at one point: "I like the old ways of addressing questions."
>
> [Lecture observation, September 2013, Main Campus].

The asking and answering of questions is commonplace in university education, notwithstanding the many different ways through which such exchanges are theorised as important elements of the learning process: in terms of sociocultural learning theory (Ashwin, 2009); formative assessment (Brown and Glassner, 1999); or simply in terms of lecturing style (Bligh, 1998). But opportunities for learning through questioning are mediated in particular ways by the push-button microphone system that is used to bridge the two campuses.

When a student presses her or his button, another button flashes on the lecturer's podium, which s/he has to push in turn in order to allow her/his answer to the question to be broadcast to the other campus. However, for the technology to work, questions are placed in a queue based upon the order in which the button was pushed; nor can the ordering of questions be changed according to relevance to the conversation. And whilst one of the purported benefits of this system is that it allows more equal participation in question and answer sessions at and across both Main and Satellite, real world usage is more complicated. Some students do not like seeing themselves on screen and so do not use the button; others prefer face-to-face conversations but do not always have the opportunity to engage in this way; and some of the lecturers resist the button-based system, whilst sometimes both staff and students lack sufficient experience of using the lecture hall technology to manage the system smoothly, and engage in workarounds such as swapping seats to enable the session to continue.

[v] The global and the local

> [The lecturer] talks about different provincial laws in Satellite with regards to assisted suicide. [She] says that Satellite should check into the rules there about it.
>
> [Lecture observation, January 2013, Main Campus].
>
> [The lecturer] is making an effort to engage the Satellite learners. She asks people in Satellite for their perspective, saying: "somebody in Satellite?" She makes a deliberate effort to engage Satellite, over and over.
>
> [Lecture observation, May 2013, Main Campus].
>
> Near the end, [the lecturer] said that there is a table of food "here", and told students in Satellite that "if they drive like Hell" they can attend the reception in Main.
>
> [Lecture observation, September 2013, Main Campus].

Notwithstanding the significant resources that are spent in creating comparability across campuses, the separateness or otherness of one in relation to the other can be seen as emerging in all kinds of ways. Sometimes this might be a curricula issue: even though time and effort has been invested in creating a body of online resources that students at both Main and Satellite can use equally, the fact that lecturers tend to speak to students at Satellite from the lecture hall at Main rather than the other way around in some way militates against the comparability that the technology is trying to accomplish. But this physical otherness not only impacts on students' abilities to ask questions or to network with staff after a class. It is also reinforced in how the lecturers talk to their students. This might be as simple as an exhortation for input (thereby, somewhat ironically, reminding everyone of the distance being travelled). It might be something more complicated, such as recognition of the different provincial legal systems that apply across the two campuses. Or it might be something that at first look appears more trivial, humorous even – a joke about attending a buffet– but that nonetheless reinforces the distances between the two campuses: will there have been a similar buffet at Satellite?

[vi] Behind the scenes

> [The] professor comes in a few minutes later and then right after, the technician comes in to show the professor how to use the equipment. The professor was looking at the little computer screen on the podium and the technician comes in and points to the other bigger screen on the podium. Their attention shifts for a few minutes – lots of pointing and moving the screens on the desk around.
>
> [Lecture observation, April 2013, Main Campus].
>
> The IT guys are aware of the fact that people sit in the same seat and respond to that: they describe recognizing people. Someone [in the lecture hall] presses the button [to ask a question]. "This guy – he asks a lot of questions. He's a smart fellow." [...] The guys who work there actually 'know' the students they're watching, meaning that they recognize them and know some things about their in class behaviours.
>
> [Technicians' control room observation, May 2013, Main Campus].
>
> [The] Technical Operations Manager is talking – going to show the students how to use the [lecture room] technology. He says that the system is the only [one] of it's kind in Canada – "groundbreaking" – [and] that it is very reliable. He says that only fifteen minutes of class time was lost in the first year and that last year there was no class time lost to glitches. The group applauds.
>
> [Lecture observation, August 2013, Main Campus].

Many areas of university provision have, particularly during the last twenty years, drawn on staff who are not recognised as academics, but who nonetheless have a key role to play in terms of curriculum delivery (Tight, 2009: 295-6): for example, English language teachers, laboratory technicians, and academic skills tutors. The particular technological demands of this distributed medical education provision position technical staff at the very centre of curriculum delivery: they upload lecturers' PowerPoints, control the microphones and the cameras, set up and troubleshoot the computers and the screens in lecture halls and seminar rooms, coordinate the recording and online storage of slides, lectures and teaching cases, and teach both staff and students how to use the technology that is in front of them. Much of the time, they work behind the scenes, in a manner akin to sound engineers in a theatre (an appropriate analogy as many of the technicians have entertainment industry backgrounds), and their intricate involvement in the curriculum is lost sight of. However, when there is a glitch, the lecturers' reliance upon their expertise and the centrality of that expertise to the educational process, becomes visible.

Conclusions: contrasting rhetoric and reality

The dominant institutional discourse of the Distributed Medical Education curriculum that is the focus of our institutional ethnography is one of technology as trouble-free, as providing newer and improved affordances for learning and teaching. Within this discourse, lecturers who are less than technologically fluent or who are

otherwise not employing ICTs in their teaching are perceived as ‘traditional’, whilst the extent to which they and their students might or might not already have or need to acquire relevant ICT capacities or competencies is not mentioned at all. Further, whilst differences between the received curriculum at different locations are tacitly acknowledged through reference to ‘comparability’, they are never seriously problematised. Instead, it is assumed that the correct use of technology can provide the solution to maintaining a coherent curriculum across both Main and Satellite campus. Our observations of the vernacular, everyday work of students and lecturers present a more complex and certainly messier assemblage of social and cultural practices. More specifically, we suggest that there are three key overlapping conclusions that emerge from our research relating to distributed medical education: hierarchies of sites; technology as an ameliorating factor in learning and teaching; and new ways of working for staff.

Our first conclusion is that there is a hierarchy in place that establishes and maintains Main Campus as superior to Satellite, and not simply in terms of the relative sizes of the student cohorts. Most of the lecturers speak from the lecture room at Main, not at Satellite: indeed, when a lecturer does address all of the students from Satellite, it causes something of a buzz. It is at Main Campus that students have the opportunity to speak to staff outside formal class time, at Main Campus that students get to ask questions face-to-face, and at Main Campus that students get to attend buffet receptions where they can mingle with peers as well as staff. The point that we wish to raise here is not to express surprise that such a hierarchical relationship exists, mindful of the history of the institution as a whole and the relative newness of Satellite. Rather, it is that the technological infrastructure that has been established in order ostensibly to bridge some of the gaps – not only hierarchical but pedagogical as well – between Main and Satellite, in fact perpetuates them.

Our second conclusion is that the use of technology does not straightforwardly lead to improvements in teaching and/or learning. What technology can be seen as doing in the context of this distributed medical education curriculum is providing new affordances or opportunities for learning. But the qualitative nature of these teaching and learning interactions needs to be problematised. It is undoubtedly beneficial for students at Satellite to be able to access the same curriculum as their peers at Main, 400 kilometres away. But there are caveats. The technological infrastructure shapes participation. The camera and microphone system impedes the flow of seminar or lecture room discourse. Students at Satellite ask fewer questions than students at Main; nor do they have the opportunity for an informal discussion once a formal session has ended: indeed, even if a Satellite student were inclined to listen in to such a discussion, the automatic shut-off function of the conferencing software would prevent this from being possible. Students at both sites make good use of digital resources, but the Satellite students also wish that opportunities for face-to-face teaching were more prevalent (Saunders and Hutt, 2014). Not all students – regardless of their physical location – want to see themselves on screen when they ask questions. Staff do not always find that the sequence in which the questions are ordered by the push-button technology is appropriate. Sometimes the technology becomes a distraction, and fluency in digital literacy cannot be taken for granted (Lea and Jones, 2011). Put simply, the technologies in use across the two sites provide not only new affordances for learning but new kinds of limitations or restrictions as well.

Our third and final conclusion is that the mode of curriculum delivery that we have explored here has generated new ways of working for the staff – academic and technical – who are involved. When giving a

lecture, staff have to learn how to use the lecture hall ICTs not only in terms of technological skills (how to operate the graphical user interface, how to moderate the button-activated question and answer system) but also in terms of wider pedagogical practice. Lecturers also have to learn to stand still so that they can be picked up by the camera, not to move around and use gesture in their teaching, to speak into the microphone, nor to spontaneously move from one place to another when answering student questions. They also have to work very closely with the technicians, who are in many ways 'pedagogic partners': technicians upload teaching and assessment materials, set up lapel microphones for lecturers and operate the cameras during discussion sessions, all the while coming to know about how the students as well as the staff operate within the curriculum. Without the technicians' work, the curriculum could not be accomplished: the lecturers' reliance on the technicians is absolute.

We suggest that the ways in which staff and students work within technologically-mediated pedagogical settings are at odds with the ways in which such environments are discursively constructed or imagined at the institutional level. We suggest that the implementation of new ICTs in higher education teaching be accompanied by a reflexive and research-driven analysis of their use within the real world of the lecture room or seminar room, irrespective of the extent to which staff and students are perceived as being competent or literate in their use (Kenney, 2012). ICTs are wonderful, unavoidable and liberating: but they are also problematic, distracting and limiting. Our study leads us to ask: can the future implementation of ICTs in university settings be more widely informed by a more critical, reflexive and research-led consideration of what they actually do and how people actually respond to them?

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